

Diabetes in Children

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How many are we talking?

- ✿ T1DM & T2DM are continuing to become more prevalent in the young children and adolescent populations
- ✿ ~ 215,000 persons <20 years of age have diabetes in the US in 2010
 - ✿ 15,600 children/adolescents are diagnosed with T1DM each year
 - ✿ 3,600 diagnosed with T2DM
- ✿ 45% of newly diagnosed cases of DM among US children and adolescents are classified as T2DM
- ✿ The prevalence of T2DM is expected to continue to grow and exceed that of T1DM by 2017

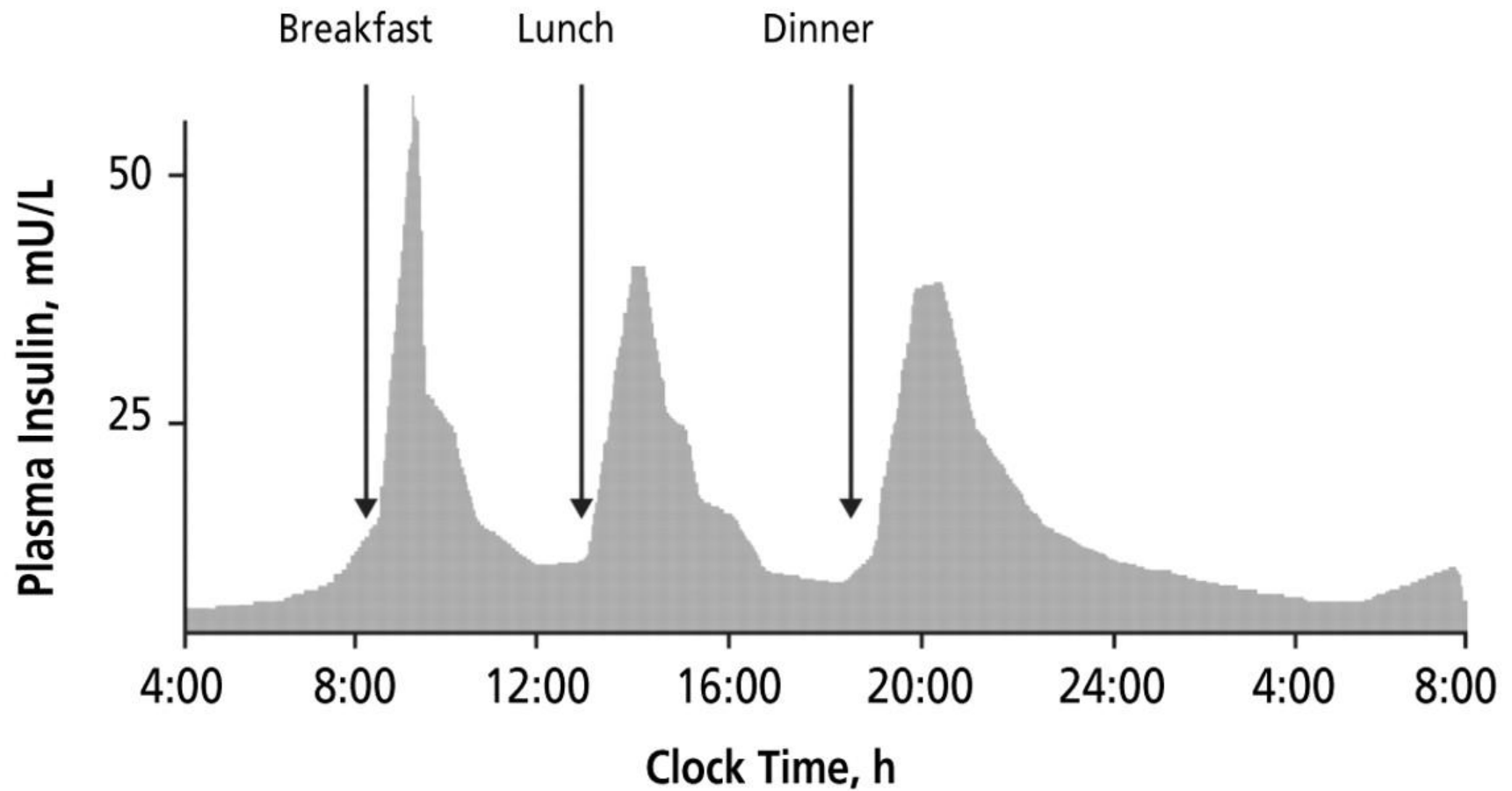
Diagnosis

- ❁ Diagnosis:
 - ❁ FPG: ≥ 126 mg/dL or
 - ❁ OGTT ≥ 200 mg/dL or
 - ❁ Random BG Screen ≥ 200 mg/dL or
 - ❁ A1c of $\geq 6.5\%$
 - ❁ Tests should be done twice to confirm diagnosis
- ❁ Diagnosis is the same in children as in adults
- ❁ Many unique challenges are faced by patients in the pediatric population

Type 1 Medications

- ❁ Insulin is the drug of choice
- ❁ Children receiving intermediate or rapid acting insulin must consume food to meet insulin action peak
 - ❁ Many children/adolescents on basal/bolus therapy with a long acting and rapid acting insulin
 - ❁ Insulin pump therapy considered as children age
 - ❁ Start at low doses and increase slowly
 - ❁ May consider rapid acting insulin after meals in very young children
 - ❁ Many children finicky eaters, and it may be appropriate to dose insulin after meals
- ❁ Symlin© is also used fairly commonly and is an amylin analog, but its use in pediatrics is off-label

Insulin



Type 1 Medications

❁ Honeymoon Phase

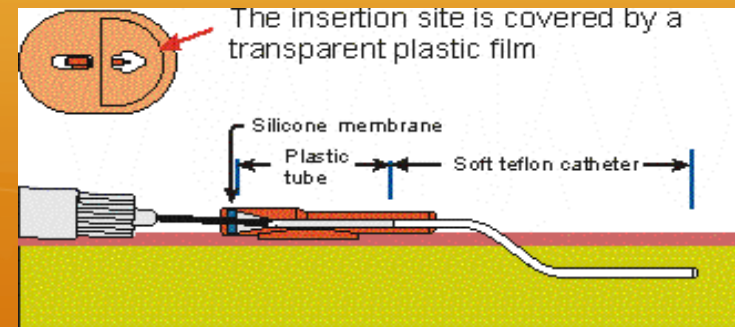
- ❁ Time period when some insulin still being produced by beta cells in pancreas, and exogenous insulin gives the beta cells a “break” stimulating insulin release naturally
- ❁ Short lived
- ❁ Not as much exogenous insulin needed
- ❁ Patient may have many euglycemic readings, but insulin therapy should not be stopped
- ❁ May have to decrease amount of insulin so that hypoglycemic events minimized
- ❁ If insulin is stopped, patient can go into DKA very quickly as honeymoon phase is sporadic

Aids and Accessories

- ❁ Hides the syringe and needle
 - ❁ Inject-Ease (Ambimed)
 - ❁ Auto-ject 2 (Owen Mumford, Inc)
 - ❁ NovoPen 3 PenMate (Novo Nordisk)



- ❁ Indwelling catheter “infusers”
 - ❁ Insuflon (Unomedical)
 - ❁ I-Port (Patton Medical Devices)



- ❁ Other
 - ❁ Buzzy (MMJ Labs)



Type 2 Medications

Approved Medications

- ✿ Insulin
- ✿ Metformin (Glucophage©) is the only approved oral medication for the treatment of diabetes in children and adolescents
 - ✿ Approved for ages >10 years

Unapproved

- ✿ Glimepiride (Amaryl©) commonly used off label for use in pediatric population
- ✿ Exenatide (Byetta©), a GLP-1 mimetic, has been used off label as it may help with weight loss
 - ✿ Long term effects are unknown

Meals

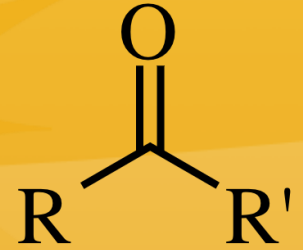
❁ A Healthy Diet for T1DM and T2DM

- ❁ Carb counting should be initiated as soon as the child/caregiver understands the concept
- ❁ Well balanced diet supporting growth and nutrition very important
- ❁ Monitor portion sizes of all meals
 - ❁ Obesity is major cause of T2DM pediatric patients
- ❁ Choose low-fat options
- ❁ Each child will need different nutrition requirements based on age, height, BMI, sex, and activity level
 - ❁ Myplate.gov can personalize each meal plan based on these specific inputs
- ❁ Evaluate height, weight, BMI, and the nutrition plan annually
- ❁ If child is overweight, weight loss and calorie restriction should be initiated
 - ❁ 10% weight loss in 6 months

Monitoring

- ✿ T1DM Children and Adolescents should be monitoring 4 or more times per day on insulin
- ✿ T2DM Children and Adolescents should be monitoring at least 2 times daily at different time intervals
- ✿ Situations Requiring Increased Frequency of Monitoring:
 - ✿ Illness
 - ✿ Increased Physical Activity
 - ✿ Emotional or Physical Stress
 - ✿ Children at increased risk of DKA in the above situations

DKA



- ❁ Acidic molecule formed when fat is broken down for energy
 - ❁ Could be not enough insulin
 - ❁ Could be not enough carbs (Atkins Diet)

- ❁ Why are you breaking down fat?
 - ❁ Illness
 - ❁ Pregnancy
 - ❁ Stress
 - ❁ Exercise
 - ❁ Medication issues

DKA

❁ Symptoms – do they have symptoms to say that the acid is excessive?

❁ Nausea

❁ Vomiting

❁ Stomach Pain

❁ Fruity Breath

❁ Kussmaul breaths

❁ Confusion

❁ Coma

BG >250mg/dL

+

And

Positive Ketones

Trace Small Moderate Large



DKA

- ❁ School should have a protocol for how to handle DKA and blood sugars based on physician's directions
- ❁ May require more insulin
- ❁ Student should drink at least 8oz of water every hour
- ❁ Child's family should have a sick day plan

Monitoring

- ❁ Hypoglycemia “sensors” in children not as sensitive as in adults, so many times children are unaware that they are hypoglycemic
 - ❁ Need for CGM (Continuous Glucose Monitoring)
- ❁ Complications of poor glucose control in pediatrics significant
 - ❁ Learning impairment
 - ❁ Cognitive and developmental impairment
- ❁ Puberty really screws stuff up...
 - ❁ Most patients experience increased insulin resistance at this phase in life
 - ❁ More likely to engage in high-risk behaviors

Hypoglycemia

- ✿ BG <70mg/dL
- ✿ Symptoms: Anxious, Rapid Heart Beat, Sweaty, Irritable, Shaky, Hunger, Unconsciousness
- ✿ 1. Check blood sugar
- ✿ 2. Eat 1 serving (15g) of carbohydrates
- ✿ 3. Wait 15-30minutes
- ✿ 4. Check blood sugar again
 - ✿ Consider when next meal will occur

Blood Sugar Goals

Table 16—*Plasma blood glucose and A1C goals for type 1 diabetes by age-group*

Values by age (years)	Plasma blood glucose goal range (mg/dL)			Rationale
	Before meals	Bedtime/overnight	A1C	
Toddlers and preschoolers (0–6)	100–180	110–200	<8.5%	<ul style="list-style-type: none"> • Vulnerability to hypoglycemia • Insulin sensitivity • Unpredictability in dietary intake and physical activity • A lower goal (<8.0%) is reasonable if it can be achieved without excessive hypoglycemia
School age (6–12)	90–180	100–180	<8%	<ul style="list-style-type: none"> • Vulnerability of hypoglycemia • A lower goal (<7.5%) is reasonable if it can be achieved without excessive hypoglycemia
Adolescents and young adults (13–19)	90–130	90–150	<7.5%	<ul style="list-style-type: none"> • A lower goal (<7.0%) is reasonable if it can be achieved without excessive hypoglycemia

Key concepts in setting glycemic goals:

- Goals should be individualized and lower goals may be reasonable based on benefit-risk assessment.
- Blood glucose goals should be modified in children with frequent hypoglycemia or hypoglycemia unawareness.
- Postprandial blood glucose values should be measured when there is a discrepancy between preprandial blood glucose values and A1C levels and to help assess glycemia in those on basal/bolus regimens.

Movement

- ❁ Goal is for 60 minutes of physical activity a day
- ❁ Hypoglycemia is the most common issue associated with exercise
 - ❁ Exercise can have prolonged effect on blood glucose values up to 18 hours
 - ❁ Risk of hypoglycemia may not occur until 1-18 hours after exercising
- ❁ Rescue glucose source should be readily available
 - ❁ Glucose Tabs/Gel, Fruit Juice, Crackers
 - ❁ Glucagon Injection
- ❁ Frequent movement will result in decreased insulin use, especially during athletic seasons in which the child participates
- ❁ Monitoring should be done immediately before activity, and blood glucose levels should be over 100 mg/dL before activity is initiated
 - ❁ Consume 15 g of CHO if below goal, and give protein source to prolong euglycemia
 - ❁ An extra 15 g of CHO may be given if intense or prolonged activity is presumed

Development

Table 2—Major developmental issues and their effect on diabetes in children and adolescents

Developmental stage (approximate ages)	Normal developmental tasks	Type 1 diabetes management priorities	Family issues in type 1 diabetes management
Infancy (0–12 months)	<ul style="list-style-type: none"> • Developing a trusting relationship/“bonding” with primary caregiver(s) 	<ul style="list-style-type: none"> • Preventing and treating hypoglycemia • Avoiding extreme fluctuations in blood glucose levels 	<ul style="list-style-type: none"> • Coping with stress • Sharing the “burden of care” to avoid parent burnout
Toddler (13–36 months)	<ul style="list-style-type: none"> • Developing a sense of mastery and autonomy 	<ul style="list-style-type: none"> • Preventing and treating hypoglycemia • Avoiding extreme fluctuations in blood glucose levels due to irregular food intake 	<ul style="list-style-type: none"> • Establishing a schedule • Managing the “picky eater” • Setting limits and coping with toddler’s lack of cooperation with regimen • Sharing the burden of care
Preschooler and early elementary school-age (3–7 years)	<ul style="list-style-type: none"> • Developing initiative in activities and confidence in self 	<ul style="list-style-type: none"> • Preventing and treating hypoglycemia • Unpredictable appetite and activity • Positive reinforcement for cooperation with regimen • Trusting other caregivers with diabetes management 	<ul style="list-style-type: none"> • Reassuring child that diabetes is no one’s fault • Educating other caregivers about diabetes management

Development

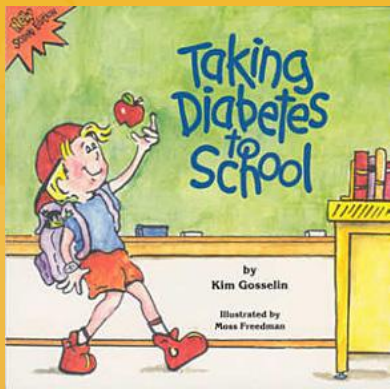
Older elementary school-age (8–11 years)	<ul style="list-style-type: none"> • Developing skills in athletic, cognitive, artistic, social areas • Consolidating self-esteem with respect to the peer group 	<ul style="list-style-type: none"> • Making diabetes regimen flexible to allow for participation in school/peer activities • Child learning short- and long-term benefits of optimal control 	<ul style="list-style-type: none"> • Maintaining parental involvement in insulin and blood glucose monitoring tasks while allowing for independent self-care for “special occasions” • Continue to educate school and other caregivers
Early adolescence (12–15 years)	<ul style="list-style-type: none"> • Managing body changes • Developing a strong sense of self-identity 	<ul style="list-style-type: none"> • Managing increased insulin requirements during puberty • Diabetes management and blood glucose control become more difficult • Weight and body image concerns 	<ul style="list-style-type: none"> • Renegotiating parents and teen’s roles in diabetes management to be acceptable to both • Learning coping skills to enhance ability to self-manage • Preventing and intervening with diabetes-related family conflict • Monitoring for signs of depression, eating disorders, risky behaviors
Later adolescence (16–19 years)	<ul style="list-style-type: none"> • Establishing a sense of identity after high school (decision about location, social issues, work, education) 	<ul style="list-style-type: none"> • Begin discussion of transition to a new diabetes team • Integrating diabetes into new lifestyle 	<ul style="list-style-type: none"> • Supporting the transition to independence • Learning coping skills to enhance ability to self-manage • Preventing and intervening with diabetes-related family conflict • Monitoring for signs of depression, eating disorders, risky behaviors

Psychosocial

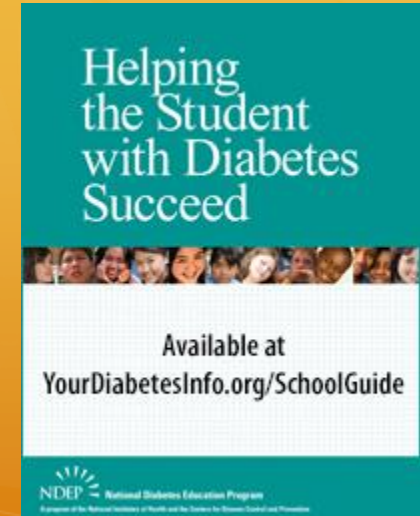
- ❁ Constant feeling of being “different” especially difficult for teenage and preteen patients
- ❁ Depression is most common psychological disorder in children with diabetes
- ❁ Managing diabetes in children or adolescents is most effective when the entire family is involved
 - ❁ Family can share necessary lifestyle modifications
- ❁ Insulin omission common to try and lose weight
 - ❁ Eating disorder also very common

Psychosocial

- ❁ Children, depending on their maturity, will learn to take over much of their care.
 - ❁ Usually started at school age, and then by high school most can manage independently
 - ❁ Time when social acceptance and independence most important, as well as rebellion most likely, making management of diabetes difficult
- ❁ Difficulties of managing disease in school
 - ❁ Cannot take medications in class or to class
 - ❁ Standardized lunch meals
 - ❁ Potentially socially awkward situations
 - ❁ Keeping everyone on the same page with care



Resources



- ❁ ADA's www.diabetes.org has a whole section on schools with training modules
- ❁ YourDiabetesInfo.org/SchoolGuide
- ❁ Local Certified Diabetes Educators



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